
Regenerative Brayton Cycle

For the Brayton cycle, the turbine exhaust temperature is greater than the compressor exit temperature. Therefore, a heat exchanger can be placed between the hot gases leaving the turbine and the cooler gases leaving the compressor. This heat exchanger is called a regenerator or recuperator. The sketch of the regenerative Brayton cycle is shown below.

EX: If a heat exchanger is used in the previous exercise ,find the cycle efficiency?

DIFFERENT ARRANGEMENT OF GAS TURBINE :

The bases equipment are:

1. Compressor
2. Combustion chamber
3. Gas turbine

2-Simple Gas turbine unit with heat exchanger :

Heat exchanger increases thermal efficiency of unit ,but cost of unit increase. Space requirement will be more,hence balance is to be made between thermal efficiency and economy and the space (constant load and speed)

3- Simple Gas turbine unit for low quality (coal):

When fuel of low quality such as coal is used in gas turbine is used in the gas turbine unit ,the product of combustion does not pass through the turbine but its enthalpy is transferred to the compressed air on a (R.H),then passes in the turbine thus avoid damage of blade of turbine .A gain constants load and constant speed .Low thermal efficiency but economical (cheaper) because (the coal is cheap).

4-Constant Speed And Variable Load In Gas Turbine Unit:

Simple G.T.U with separate power turbine (low pressure turbine)(L.P.T)

$$W_{c.T} = W_C \quad (\text{compressor})$$

$$W_{p.T} = W_{\text{gen}} = W_{\text{net}}$$

Control of power output is made by controlling the mass of fuel supply in (C.C).

5-Constant speed an variable load in gas turbine unit with reheater(or C.C for power turbine):

6-Complex G.T.U With Inter Cooler (I.C) And Reheater (R.H) Of (H.E):

(C.C) is used to raise the maximum temperature of cycle (T_8), hence sub turbine is increased and more work (W_T) is obtained, to reduce work of compressor (W_C) we should reduce the temperature (T_2). Since

$$W_C = C_P(T_2 - T_1)$$

Is function of (T_2) as (T_1) is constant. (T_2) can be reduced by inter cooling the air between the stages (cooling of air reduce the total power requirement) a complex gas turbine unit is use fuel in producing large equinity of thermal power in a stationary thermal power station where no problem of space

